The Canadian Entomologist

VOL. LVI. ORILLIA, JUNE, 1924. No. 6.

YELLOW PINE (*PINUS PONDEROSA*) AS A HOST IN BRITISH COLUMBIA*

BY RALPH HOPPING

Vernon, B.C.

During the course of several field seasons of forest insect control work it became evident that our knowledge of infestations was not sufficiently definite and Dr. J. M. Swaine and the author arranged to conduct a series of experiments by caging the whole of infested trees.

At first it seemed a very difficult undertaking to cage a tree from 100 to 200 feet in height and 18 inches to 32 inches in diameter. Our method of procedure was finally comparatively simple and the results so far have justified the experiments.

The objects of the study were:

1. To determine the amount and nature of the emergence from an infested tree of the primary or killing bark beetles.

2. To determine the species and number of secondary bark beetles concerned in the attack.

3. To determine what other insects breed in these trees, neutral, parasitic and predaceous.

4. To determine the relations of these insects to the death of the trees and to each other.

A platform of one-inch boards was built and covered with white dairy cloth upon which the infested tree was rolled, being cut before any emergence occurred. The branches were then piled on top and a frame constructed which was also covered with white dairy cloth, the whole being made perfectly tight to prevent the escape of the most minute insect. The frame was placed entirely outside of the cloth covering in order to prevent any insect emerging from the wood of the frame. A tight fitting door, built at the end, enabled the collector to enter and collect the daily emergence, the cage being six feet in height and as long as necessary to contain the tree selected. Collections were then made daily throughout the season, from the time of the first emergence until the last, a period of from ten to twelve weeks.

In 1921 a yellow pine (*Pinus ponderosa*), 18 inches D.B.H., was caged. In 1922 a yellow pine (*Pinus ponderosa*), 24 inches D.B.H., a Douglas fir, (*Pseudotsuga taxifolia*) and a lodge-pole pine (*Pinus contorta*) were enclosed. In 1923 another yellow pine (*Pinus ponderosa*) was caged, 32 inches D.B.H. In 1921 and 1922 the stumps were not included in the cages and no attempt was made to separate the trunk, top and branches. In 1923, however, stump, trunk, top (above 12 inches in diameter) and branches were caged separately.

It is the purpose of this article to deal only with the results from yellow pine. Douglas fir and lodge-pole will be treated in a separate paper. The

*—Contribution from the Division of Forest Insects, Entomological Branch, Department of Agric., Ottawa.

results have been remarkable, showing not only the large numbers of certain species but the large number of insect species breeding in infested trees of this type.

The experiments have also demonstrated the need of further information on the biological relations of these insects. It would naturally be supposed that large numbers of certain predaceous beetles, such as Clerids, would be recovered. The number has been, however, exceedingly small and much smaller of the predators *Temnochila chlorodia* Mann. The number of parasitic Hymenoptera and Diptera, on the other hand, has been unexpectedly large.

In British Columbia, where these experiments were conducted, the bark beetles responsible for killing the yellow pine are of two species, *Dendroctonus brevicomis* and *Dendroctonus monticolae*. The numbers recorded from each tree have been as tabulated below:

Year	Diameter of tree	Dendroctonus brevicomis	Dendroctonus monticolae	Total
1921	18	62	4121	4183
1922	24	1694	4699	6393
1923	32	4547	2423	6970

It will be seen from the above table that the smaller the tree the greater was the proportion of *Dendroctonus monticolae*, and the larger the tree, the greater the proportion of *Dendroctonus brevicomis*; and further, that each infested tree in a forest produces from four to seven thousand adults, at least in trees up to a diameter of thirty-two inches D.B.H.

The secondary bark beetles, however, cannot be ignored, since they are often what may be termed subprimary, attacking a large part of the tree and probably enabling the *Dendroctonus* to overcome the resistance more readily.

Of these subprimary bark beetles we may consider *Ips, Pityogenes* and *Orthotomicus,* which were more or less numerous in all three trees, the *Orthotomicus* attacking the main part of the trunk more than *Pityogenes* and *Ips,* as will be shown later.

Often, in epidemics, the limbs will be attacked by *Pityogenes* and the tree killed without any *Dendroctonus* or other primary attack on the trunk; and again, cases have been studied in which the branches were killed by these secondary beetles on only one side of the tree, the branches and trunk on the opposite side not being attacked and surviving for at least another year or more.

TABLE 2.

Year	Diameter of tree	Ips interpunctus	Pityogenes carinulatus	Orthotomicus ornatus	Total
1921	18	996	257	162	1415
1922	24	1651	4998	63	6712
1923	32	1673	12412	1958	16043

Other species of *Ips* emerged from these trees but they were so few in number as to be of little importance. Of Clerids the 18 inch tree produced one, the 24 inch tree one and the 32 inch tree 38. During the emergence in the open the Clerids were numerous upon the trunks, preying upon the emerging beetles. It would appear, therefore, that in control operations the burning of the trees does not destroy many Clerids and that the exact relation of their breeding habits to that of Dendroctonus is yet to be determined.

By far the most interesting results were, however, obtained from the 32 inch tree confined in four cages, separating the stump, trunk, top (less than 12 inches diameter) and limbs. It is a very good indication of what may be expected of stumps left from cutting operations of lumber mills and of tops and slash remaining on the ground. The tops and limbs probably would not give as great an emergence of *Dendroctonus* but the stump would probably show about the same numerical strength.

TABLE 3

Tree 32 Inches D.B.H.	Stump	Trunk	Top	Limbs	Total
D. brevicomis	567	3977	1	2	4547
D. monticolae	10	836	1497	80	2423
Pityogenes carinulatus	2	42	80	12288	12412
Ips interpunctus	0	33	21	1619	1673
Orthotomicus ornatus	5	1299	548	106	1958
Clerids	11	10	6	11	38

From table 3 it will be seen that all but three of the *Dendroconus brevicomis* came from the stump and trunk, and all but 90 *Dendroctonus monticolae* from the trunk and top; that the limbs bred 82 beetles of the genus Dendroctonus, the top 1498 and the stump 577. The top, limbs and stump are all left on the ground in logging operations, and we know they are heavily attacked by Ips, Dendroctonus and other bark beetles, although perhaps not always in the proportions given in this table. It is, nevertheless, more than an indication of the danger of leaving unburned slash and stumps upon a logged-off area without destroying them at the proper time.

The best efforts of control crews have never resulted in being one hundred per cent effective the first year. Always there have been from ten to thirty-five percent of reinfestation. In California Mr. J. M. Miller, of the United States Bureau of Entomology, and the author, found that small colonies of Dendroctonus existed just below tops of yellow pines killed by *Ips oregoni*, and that certain windfalls in a forest also supplied a certain number for reinfestation which we termed for convenience "hidden infestation." Among men acquainted with the forest insect control work, a few Dendroctonus have been known to hold over in abandoned trees until the next year; but nothing seems to be known as to the extent of this "hold over", which is another factor in the so-called "hidden infestation". It was intended to carry the cage experiment of 1921 over into the second year, but in the spring of 1922 it was found that loggers had felled several trees across the cage, thus effectively ending the experiment. The 1922 tree of 24 inches D.B.H. was, however, continued throughout 1923. The emergence of Dendroctonus this second year in the cage was 243, or five and one-half per cent. of the original emergence the year before.

Other trees will be carried through a second and third year to determine if five and one-half per cent. is what may normally be expected. The stump, however, was not included in this experiment, so that in all probability the percentage is much higher than five and one-half.

The extent or time of the emergence of the different bark beetles was of great importance to the control work. All bark beetles respond to cloudy, cool or rainy weather to a marked degree, the daily emergence immediately dropping

under such conditions and at once rising on hot sunny days. The peak of Dendroctonus emergence is given in Tables 4 and 5.

TABLE 4.

Dendroctonus brevicomis

Tree	1st emergence	Peak of emergence	Last emergence	Period of emergence in large numbers	Remarks
18 in.	1921	July 17	July 22	Aug. 18	July 19 to 25	Total of only 62 in tree
24 in.	1922	June 18	July 24	July 29	June 20 to July 6	Total of 1751
32 in.	1923	June 19	June 25	July 18	June 22 to July 11	Total of 4547

TABLE 5

Dendroctonus monticolae

Tree	1st emergence	Peak of emergence	Last emergence	Period of emergence in large numbers	Remarks
18 in.	1921	July 17	July 19	Aug. 26	July 17 to Aug. 1	Total of 4121
24 in.	1922	June 25	July 28	Aug. 24	July 4 to Aug. 3	Total of 4543
32 in.	1923	June 25	July 12	Aug. 15	June 29 to July 25	Total of 2423

From these dates we may safely say that it is not advisable to conduct much control work in yellow pine for infestations of Dedroctonus later than June 20, in ordinary seasons in British Columbia. It is also evident that the heavy emergence lasts from two to four weeks, generally, somewhat shorter in *Dendroctonus brevicomis* than in *Dendroctonus monticolae*.

TABLE 6

Insects Collected in the Cages

Tree		Coleopt.	Dipt.	Hymenopt.	Hemipt.	Lepidopt.	Total
18 in.	1921	5754	108	103	16	21	6002
24 in.	1922	15968	2848	73	65	8	18962
32 in.	1923	25935	2180	502	181	29	28827

In this article has been shown the approximate numbers of emergence which may be expected from trees of certain diameters of the primary *Dendroctonus*; the enormous number of some of the secondary beetles which occasionally become primary and breed in tops, limbs and stumps; the relation of emergence from stump, bole, top and limbs; and an indication of the emergence of *Dendroctonus* the second year from trees abandoned by *Dendroctonus* the previous year.

NEW CANADIAN EPHEMERIDAE WITH NOTES, II*

BY J. MCDUNNOUGH,
Ottawa, Ont.

(Continued from page 122)

Siphloplecton interlineata Walsh

I have already called attention in my previous paper to the fact that on the strength of the forewing venation the genus *Siphloplecton* falls into the Heptageninae. It agrees with *Iron* in the comparative lengths of the fore tarsal joints in the male sex but may be separated by the short tibiae in all three pairs of legs

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

and by the fact that the fore tibia shows a distinct dorsal row of small spines. *Flexus* Clem., the type species, is evidently a synonym of *basalis* Wlk.; a second closely related species has been taken in numbers by Mr. N. Criddle at Aweme, Man., which I at first regarded as undescribed. However, in reading through Walsh's description of the species identified by him as *femoratus* Say I was struck by the similarity to our Manitoba species, and correspondence with Dr. Banks, who kindly examined the specimens sent by Walsh and Hagen, elicits the information that Walsh's specimens fall into *Siphloplecton* and not into *Siphlonurus* as placed at present in catalogues. As there was considerable doubt expressed at the time as to the correctness of Walsh's determination, Walsh himself (1863, Proc. Ent. Soc. Phil. II, 190) proposed the name *interlineata* for the species, which name I shall use, leaving *femoratus* Say for the present unidentified. From *basalis* the species is distinguished by the paler abdomen and more restricted brown shading at the base of the wings in the male sex; the crossveins are pale except in the costal and subcostal regions and along the basal portion of the median vein.

Genus **Iron** Eaton

Under this genus I include all our North American species in which the first three tarsal joints of the ♂ are long and subequal. Several of the species have been described under the generic name *Epeorus* Eaton but this genus is based on a European species (*torrentium* Eaton) in which the ungues of the fore tarsus in the ♂ are stated to be similar, whilst in all the North American species with which I am acquainted they are dissimilar; whether the other differences used in separating these two genera, notably the comparative lengths of the joints of the hind tarsus, are of generic value, I am not at the present time prepared to say.

Used in the above sense, *Iron* contains the following species:—*longimanus* Eaton; *pleuralis* Banks, which according to Ulmer (1920, Stett. Ent. Zeit., 81, 142) is a synonym of *longimanus* but which I prefer to hold distinct for the present; *nitidus* Eaton; *fragilis* Morgan; *humeralis* Morgan; *modestus* Bks.; *californicus* Bks. and *tollandi* Dodds. Of these species *longimanus* occurs in Alberta and has been taken by me at Waterton Lakes and at Nordegg; what from the genitalia appears to be *humeralis* is fairly common here at Ottawa in late June; the following undescribed species also occur in our Canadian fauna.

Iron albertae n. sp.

Male. Very similar to *longimanus* but best distinguished, apart from ♂ genitalia, by the black humeral crossvein on primaries. Eyes (living) blue-gray; thorax light brown with darker central band spreading out on rear portion of mesothorax where there is a median spot of pale ochreous. Abdomen dorsally with segments 2-6 semihyaline, slightly smoky, with posterior transverse bands of brown; posterior segments largely brown, ventrally segments 2-7 pale, hyaline, with faint traces of medioventral spots, segments 8-10 creamy, opaque. Forceps creamy, tipped with brown, setae brown, legs pale brown with dark spot on centre of each femur and the joints tinged with dark brown. Wings hyaline with venation fine, inconspicuous, pale brown, except the humeral vein on primaries, which is marked with blackish. Length of body 10 mm.; of forewing, 11 mm.

Female. Similar to ♂ but rather paler.

Holotype—♂, Waterton Lakes, Alta., July 24, (J. McDunnough); No. 718, in Canadian National Collection.

Allotype—♀, same data.

Paratypes—11 ♂, 6 ♀, same locality and collector, July 19-26. The lack of the rounded projection of the subgenital plate (Pl. I, fig. 4) found in *longimanus*, is quite characteristic of the present species.

Iron grandis n. sp.

Male. Head light brown shaded with smoky; thorax light olivaceous brown, with two black lateral lines extending forward from base of wings; abdomen dorsally deep brown with a broad pale yellowish lateral border and a series of pale yellow subdorsal patches on posterior portion of each segment; these patches are obsolete on segments 2 and 3, faint on 4, large on 5-8, occupying more than half the segmental area and separated by a narrow brown line from each other. The brown area occupies the anterior third of each segment and juts into the yellow patches dorsally as a dark triangle, laterally it separates these patches from the yellow lateral border and broadens out on the posterior portion of each segment, causing the dorsal edge of the yellow border to appear very irregular in outline; segments 9 and 10 dorsally almost entirely yellowish. Ventrally the abdomen is purplish brown, paler posteriorly; forceps smoky brown with light brown base; setae deep black brown, forelegs black-brown, paler at base of femur; other legs light yellow-brown, unmarked. Wings hyaline with narrow dark veining, pterostigmatic area slightly tinged with brown and with crossveins anastomosing with each other. Length of body 11 mm.; of fore wing 14 mm.

Female. Similar to ♂ but generally paler with more extended yellow areas on abdomen.

Holotype—♂, Waterton Lakes, Alta., July 23, (J. McDunnough); No. 719, in Canadian National Collection.

Alltoype—♀, same locality, July 20.

Paratypes—1 ♂, 5 ♀, same locality and collector, July 15-23; 2 ♂, Hedley, B.C., July 21, (C. B. Garrett.)

The entire series from Waterton was secured through subimagos flushed from bushes bordering Cameron Creek near its junction with Waterton Lake. The description is drawn up from a well-marked specimen; in other specimens the abdominal maculation is often blurred by a reddish suffusion or by an extension of the dark areas.

Genus **Cinygma** Eaton

It is possible that the generic name *Cinygma* may fall to *Iron* Eaton but for the present I am retaining it in Eaton's sense for those species in which the first tarsal joint in the ♂ anterior legs is long but yet noticeably shorter than the second joint. It includes a number of delicate species, with a tendency to amber-colored wings, which are superficially very similar but which may be separated by characters found in the ♂ genitalia. In order to satisfactorily determine these characters it is necessary to make a slide of the parts in question as they have a great tendency to distortion in dried material. Eaton's figures of the genitalia of *integrum* and *par* (Mon. Pl. LXV, figs. 4, 5) from dried specimens are probably inaccurate and until it is possible to examine the types in the MacLachlan

collection or secure adequate material from the type localities (Oregon, Arizona) the identity of these species will remain doubtful.

Cinygma mimus Eaton

Through the kindness of Dr. Banks, specimens of the type series from Manitou, Colo., are before me. An examination of the ♂ genitalia shows that the species doubtfully recorded and figured by Dodds (1923, Trans. Am. Ent. Soc., XLIX, 106, Pl. VIII, fig. 18) is not the true *mimus*, the genitalia of which are quite different, as shown herewith (fig. 7).

I captured a long series of *mimus* early in July, at Waterton Lakes, Alta., where on certain days it occurred commonly in the late afternoon along the lake shore; it is readily recognized by the rather yellow-brown tint of the wings, this color being strongest in the basal half of the wing; in allied species the tint of the wing is deeper and more evenly suffused over the entire surface.

Cinygma atlantica n. sp.

Male. Head between the eyes dark brown, thorax light brown shaded with dark brown laterally on prothorax. Abdomen dorsally with segments 2-6 pale, semihyaline, shaded with brown; the brown color occupies the greater portion of segments 2 & 3, leaving a pale centrodorsal area; on the other segments this color is restricted more to the posterior lateral areas; there are traces of subdorsal pale vittae, outlined partially with brown; posterior segments almost entirely brown. Ventrally the abdomen is pale ochreous, becoming opaque on posterior segments. Setae brown, forelegs smoky brown, other legs yellowish brown. Wings hyaline, untinted, with all veins fine, brown. Length of body 7 mm.; of fore wing 8 mm.

Holotype— ♂, Kentville, Nova Scotia, June 25, (R. P. Gorham); No. 720 in the Canadian National Collection.

The genitalia (fig. 12) show the species to be allied to *par* Eaton.

Cinygma confusa n. sp.

Head deep red-brown; thorax light olive brown, shaded with darker brown centrally and with purplish tinges on prothorax and laterally below the wings. Abdomen with segments 2-7 hyaline, banded on posterior half of each segment dorsally with purple-brown and with indistinct pale subdorsal vittae outlined in brown and most distinct on segments 2 & 3, where the brown color extends over a larger portion of each segment. Rear segments light brown, opaque, slightly shaded with purplish dorsally and paler ventrally; on hyaline segments a centroventral row of purplish patches. Forceps smoky, brown at base; setae deep black-brown; legs with light brown coxae, fore femur deep purplish, remainder of foreleg blackish, other legs light purplish brown. Wings evenly suffused with deep amber color, with dark, clean cut venation. Length of body 9 mm.; of forewing 10 mm.

Holotype— ♂, Moraine Lake, Alta., Aug. 1, (J. McDunnough); No. 723, in Canadian National Collection.

Paratypes—8 ♂, same data.

The type series was captured swarming in late afternoon over a small creek at the junction of the Moraine Lake and Lake Louise roads; I secured a series of the same species at Waterton Lakes, Alta., on July 7, from subimagos emerging from a mountain brook, which later dried up. The genitalia (fig. 9) are very similar to those of the Colorado species figured erroneously by Dodds

as *mimus* (1923, Trans. Am. Ent. Soc., Pl. VIII, fig. 18); this Colorado species probably represents the true *par* Eaton which has evidently a basal spine on the penis (rather misplaced in Eaton's drawing); I have made slides of the genitalia of two specimens received from Dr. Dodds and find them larger and stouter than in our Alberta forms and slightly differently shaped at apex of penis. I have also before me a long series of dried specimens from Tolland, Colo., which show the dark brown shading at base of wing mentioned by Eaton, the remainder of the wing being practically pale hyaline gray.

Cinygma hyalina n. sp.

Male. Very similar to the preceding species. It can best be distinguished by the hyaline wing-membrane which is untinted, except for a slight shade in the pterostigmatal area. In mature specimens the thorax is slightly deeper in color than in *confusa*; the banding of the abdomen shows less purple tinges in the brown color and the definition between the pale and dark areas is less distinct; segments 2 and 3 are almost entirely brown and there is only a trace of the pale subdorsal vittae; the ventral area is more opaque, being suffused with whitish; the legs also show no purple tinge but are light to deep brown. The differences between the ♂ genitalia (fig. 8) of the two species are slight but seemingly constant; the best distinction is found in the length of the basal spine of the penis.

Holotype—♂, Moraine Lake, Alta., Aug. 6, (McDunnough); No. 724, in the Canadian National Collection.

Paratypes—3 ♂, same locality and collector, Aug. 5, 6, 10.

There are also before me several specimens of both sexes from Waterton Lakes, Alta., (July 15-23) and 1 ♂, 3 ♀, from Banff, Alta., (July 19, Aug. 21) which appear to belong here.

Cinygma ramaleyi Dodds

This species was described (l. c. p. 101, fig. 9) as an *Ecdyurus*. I have a ♂ before me, received from Dr. Dodds, which has lost its forelegs; a number of other specimens recently received from various localities in Colorado agree with Dodds' specimen in general appearance and in genitalia (fig. 11); these show the *Cinygma* type of foreleg and fit in well in general habitus with the other members of the group. The species occurs in Canada and in the Canadian National Collection there is a series captured at Banff, Alta., early in September.

Cinygma deceptiva n. sp.

Male. Bears the same relation to *ramaleyi* that *hyalina* does to *confusa*, having the wing membrane clear, hyaline; type of maculation similar to that of the preceding species. The genitalia of the ♂ (fig. 10) are quite distinct and the rounded projection of the subgenital plate between the bases of the forceps (as in *Iron longimanus*) is an easy means of identification.

Holotype—♂, Banff, Alta., Sept. 5, (C. B. Garrett); No. 726, in the Canadian National Collection.

Allotype—♀, same data.

Paratype—1 ♂, same data.

The two males before me have unfortunately lost their forelegs but on account of the general similarity I place the species in *Cinygma*. It is possible that it is this species, the genitalia of which are figured by Dodds (l. c. fig. 22) as representing a mature form of *Iron longimanus*; in a long series of this latter species

examined by me the genitalia all correspond with Eaton's figure and Dodds' fig. 21, and as no cases are known to me of a radical change in the shape of these organs in the adult males, I presume that two species have been confused by Dr. Dodds under the name *longimanus*.

EXPLANATION OF PLATE 1.

1. Male genitalia of *Iron grandis* McD.
2. Male genitalia of *Hexagenia atrocaudata* McD.
3. Male genitalia of *Hexagenia rigida* McD.
4. Male genitalia of *Iron albertae* McD.
5. Male genitalia of *Leptophlebia moerens* McD. (lateral view)
6. Male genitalia of *Leptophlebia mollis* Eaton.
7. Male genitalia of *Leptophlebia volitans* McD.
8. Male genitalia of *Leptophlebia guttata* McD.
9. Male genitalia of *Ieptophlebia heteronea* McD.

EXPLANATION OF PLATE 2.

1. Male genitalia of *Heptagenia flavescens* Walsh.
2. Male genitalia of *Heptagenia inconspicua* McD.
3. Male genitalia of *Ameletus vernalis* McD.
4. Male genitalia of *Heptagenia maculipennis* Walsh.
5. Male genitalia of *Heptagenia juno* McD.
6. Male genitalia of *Heptagenia hebe* McD.
7. Male genitalia of *Cinygma mimus* Eaton.
8. Male genitalia of *Cinygma hyalina* McD.
9. Male genitalia of *Cinygma confusa* McD.
10. Male genitalia of *Cinygma deceptiva* McD.
11. Male genitalia of *Cinygma ramaleyi* Dodds.
12. Male genitalia of *Cinygma atlantica* McD.

SEVEN NEW SPECIES OF RHAPHIUM (DOLICHOPODIDAE, DIPTERA)*

BY C. HOWARD CURRAN,

Ottawa, Ont.

In the following pages seven species of *Rhaphium* occurring in Canada are described for the first time. The genera *Xiphandrium* Loew and *Porphyrops* Mg., are not considered distinct from *Rhaphium* as all these genera intergrade perfectly. Six of the species described would come under the genus *Porphyrops*. One (*R. arborium*) would be placed in *Xiphandrium*.

It was originally intended to deal fully with the Canadian species, but after this paper had been practically completed a large number of undescribed species were received from Dr. J. M. Aldrich and it was considered advisable to omit all but descriptions of new species at present and proceed with a monograph of the North American species. Types of all the species herein described are in the Canadian National Collection, paratypes of all but *R. petchi* in the United States National Museum.

Rhaphium campestris new species

Face narrow, white, third antennal joint acute, nearly three times as long

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

as wide, anterior femora black, the hind ones black on upper half except sometimes (in tenerals), the basal fifth.

Length, 6 mm. *Male.*—Face narrow, slightly widened above, silvery white. Front dark green, scarcely greyish pollinose, but narrowly brownish below. Orbital cilia black, reaching to about the middle of the eyes, the beard white. Occiput green, grey pollinose on lower half or more. Palpi black, covered with silvery pollen and clothed with whitish hair. Proboscis black. Antennae black, the third joint tapering to a point from just beyond the base, about two and one-half times as long as wide, the arista thickened on basal joint and not strongly differentiated.

Mesonotum and scutellum bright green, with a pair of brownish vittae on the anterior three-fourths which lie between the dorso-central and acrostical bristles. Lateral declivity behind the suture blackish; humeri greyish pollinose. Pleura green, with some blackish areas, especially marked below the wing base, rather densely greyish pollinose. Prothorax white pilose. Scutellum evenly convex apically, with four bristles, the outer ones weak.

Coxae green and black, with greyish pollen, the pile greyish yellow, the middle coxae with a few strong apical bristles in addition to the black spine, the posterior coxae with a black bristle exteriorly but without apical spine; the anterior coxae without black bristles. Trochanters mostly blackish. Anterior femora green, with thin greyish dust, their apex and sometimes the narrow base reddish; posterior femora reddish on the lower half, (sometimes on the base above and apically) the upper half or less shining black or brownish black, the posterior tibiae brown except the dorsal surface on the basal two-thirds or less, their tarsi brown or black; middle and hind tarsi blackish from the apex of the first segment, the legs elsewhere reddish. Anterior tarsi short, the first joint twice as large apically as basally, the second also enlarged apically, not twice as long as the width of the first. Anterior femora with two preapical bristles in front, and four or five behind, two on the upper, the remainder on the lower margin, the middle femora with two in front and three behind, the posterior femora with one in front and two behind; anterior four femora with rather long whitish hair below, the legs elsewhere with black hairs and bristles.

Wings tinged with brown, the large crossvein broadly whitish. Squamae and halteres yellow, the former with white ciliae.

Abdomen green, the incisures blackish, the green portion conspicuously greyish white pollinose, the pollen more condensed laterally; the hairs black, the sides with longer whitish hairs. Genitalia partly hidden, the outer lamellae yellowish with a brown upper margin and apex, elongate oval, the longer hairs black, the others pale. Inner lamellae brownish, becoming reddish on apical half, broad, elongate-triangular.

Female. Length 6.5 mm. Face wide, the upper section very slightly wider than long, the whole lower two-thirds of the head yellowish grey pollinose, the front except immediately above the antennae blackish bronze, the occiput apparently similar. Beard yellowish. Palpi large, triangular, black in ground colour, the tip reddish, the hairs black.

Mesonotum bronze-black, brown pollinose, the pollen leaving a narrow, almost bare stripe on the outer side of the acrosticals, which are small. The prescutellar depression green, with greyish pollen. Pleura green, with grey pollen.

Coxae green, their apices narrowly reddish, densely greyish pollinose and clothed with greyish yellow hair, the middle ones with several black bristly hairs apically, the hind ones with a black bristle before the apex on the outer side. Legs reddish, the posterior femora slightly darker above apically, the narrow base of the posterior tibiae, the apical fifth on the posterior side and the posterior tarsi wholly black, the remaining tarsal joints as in the ♂. Femora with bristles as in ♂, but they are weaker, the pale pile much shorter. Anterior tarsi practically simple.

Wings as in ♂. Abdomen similar.

Holotype— ♂, Treesbank, Man., June 2nd, 1923, (H. A. Robertson), No. 644, in the Canadian National Collection, Ottawa.

Allotype— ♀, Banff, Alta., July 1, 1922 (C. B. D. Garrett), in Canadian National Collection, Ottawa.

Paratypes — ♂, Aweme, Man., August 4, 1923; ♂, Darlington, Man., August 3, 1923, (H. A. Robertson), ♂, Oxbow, Sask., June 18, 1907, (F. Knab). ♀, Douglas Lake, B.C., May 29, 1923 (E. R. Buckell).

The two last mentioned specimens are deposited in the United States National Museum.

This species is characterized by the pale fascia about the crossvein, which at once distinguishes it from any species described.

Rhaphium punctitarsis new species

A peculiar species having lamellae, which are formed of triangles borne on a short stem, their anterior edge transverse but still somewhat concave and dentate, their inner edge straight, the outer-posterior edge gently convex, and with the apical half of the third joint of the middle tarsus pure white, the tarsus yellow basally, black beyond.

Length, 5 mm.; antennae slightly over 1 mm. *Male.* Face rather narrow, its sides almost parallel, perhaps slightly convex about the middle, silvery white. Front blue or green, at least bluish in the middle above, polished; black immediately above the antennae. Occiput green, whitish pollinose except above; cilia black to the level of antennae, the hair white. Antennae black, first joint thick, not long; third joint not quite as long as the height of the head, tapering from base to apex, wider than the second joint at the base, without noticeable pubescence; arista about one-third as long as third joint. Palpi yellow, white pollinose apically, their hair white, proboscis brown.

Mesonotum green, thinly pollinose, the pollen appearing to form greyish yellow vittae in some lights. A polished bronze area before the root of the wing; sides before the suture white pollinose. Pleura blue-green or partly blackish, moderately white pollinose.

Coxae green, whitish pollinose, white pilose, the middle ones with an apical pencil of black hair, the posterior ones with a weak pencil of only four or five hairs. Legs reddish yellow; posterior femora with a black streak on basal half below, above either wholly black or pale on the middle part, the apical sixth, extending basally above, black; posterior tibiae and tarsi and last two joints of remaining tarsi, black. Apical half of third joint of middle tarsi white. Long pile behind the front femora and shorter pile beneath the remainder basally, white, the pile elsewhere black, the white part of the tarsi bare. Front basi-

tarsus more swollen than usual apically; third joint of middle tarsi as long as the two following, scarcely as long as the second; first joint of hind tarsi slightly shorter than second. Preapical femoral bristles farther from apex than usual, the middle femora with two, the posterior one at apical sixth, the hind femora with one small one.

Wings cinereous, somewhat narrower basally than is usual. Squamae yellow, with white ciliae. Halteres yellow.

Abdomen green, whitish pollinose laterally, brassy on dorsum, the bases of the segments bronzed, darker at immediate base; sixth segment black Pile black, white laterally. Genitalia short, roundish, black, the lamellae as described above, their stem brownish yellow, the broad apex polished black, the teeth and outer margin with moderately long, fine yellow hairs.

Female. Face wider, silvery white; palpi yellow, becoming black on basal third, their pile black. Front bright blue; dull brown below the transverse carina. Third antennal joint three times as long as wide, two-thirds as long as the face, elongate triangular, its lower edge slightly concave sub-basally; arista slightly longer than the face

Front coxae very narrowly pale apically; middle coxae margined with strong black hairs apically, their apex narrowly pale. Posterior femora at most slightly brown at base below and above, their apical sixth black. Posterior tibiae and tarsi and apical two and a half joints of the front four tarsi, black, though sometimes only the last two joints black, the second joint often brownish.

Holotype—♂, Hull, Quebec, June 10, 1923, (C. H. Curran); No. 624 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—♂, 5 ♀, same data, 2 ♀, June 6, (C. H. Curran).

R. punctitarsis is a wood-dwelling species, being found along streams in shady places. I have found it only resting on leaves, and have failed to take it by sweeping.

Rhaphium armatum new species

Length, 5 mm.; antennae 1.25 mm. *Male*. Face as wide as the first antennal joint, slightly wider above, densely silvery white pollinose. Front green, the ground color largely obscured by white pollen so that it only shows weakly above, the anterior margin and sides below blackish. Occiput green, slightly brassy or bronzed, narrowly white pollinose on lower three-fourths along the orbits; upper cilia black, the beard white, not dense. Antennae black, third joint as long as height of head, gradually tapering from its base, very short pubescent; arista slightly longer than first two antennal joints. Palpi black, White pollinose in front, where there are also a few white hairs; proboscis blackish.

Mesonotum rather blackish green, not brilliantly shining, with two approximate bronzed stripes on the middle line, the sides before the base of the wings whitish pollinose. Pleura with two or three paler green areas, but generally blackish green, with moderately abundant whitish pollen.

Coxae, femora and posterior tibiae and tarsi, black or green, the apices of the trochanters and extremely narrow bases of the femora, yellow; apices of front four femora, their tibiae, first four joints of middle tarsi and the anterior

basitarsi, except the apex, yellowish, joints of middle tarsi infuscated apically, the front tarsi brownish. Coxae entirely white haired, no black bristles; legs with short, appressed black pile except white hair as follows: Behind the front femora, where it is abundant, considerable long hair behind the middle femora; a few long hairs at the base of the posterior ones on the upper surface. Middle femora with one or two preapical bristles on front surface and two on posterior surface. First joint of front tarsi incrassate apically, the posterior femora increased in width from the slender base almost to the apex. Middle coxae with strong black pencil, posterior coxae lacking one.

Wings slightly fuscous, more so in front. Squamae yellow, with white ciliae. Halteres yellow, the stem short and slightly fuscous.

Abdomen brassy green, the incomplete bases of the segments bronze-black on basal half or less, the fifth segment almost all this color, the sixth segment more blackish. Pile black, moderately long, on the sides longer, white. Genitalia black; outer lamellae short, rather narrow, fuscous, with short yellow marginal hair apically; inner lamellae as long as the outer, sharply curved away from the body near their apex, at the point of the curve sending forward two slender filaments, which curve sharply upwards, then again forwards to end in a fine, acute point; these lamellae are black as far as the curve, thence bright yellow.

Holotoype— ♂, Hull, Quebec, June 15th, 1923. (C. H. Curran); No. 625, in the Canadian National Collection, Ottawa.

Paratype— ♂, Colden, N.Y., May 23, 1909 (M. C. Van Duzee).

This species is difficult to place. It has the aspect of *P. melampus* Lw., but shorter genitalia and longer hind legs; still the antennae indicate relationship to *melampus*. The long legs place the species near *crassipes, canadense*, etc.

Rhaphium canadense new species

Allied to *tridactyla* Frey of Europe and *tricaudata* V. D. from Alaska. Genital lamellae with three branches; middle femora wholly yellow.

Length 4 to 4.5 mm. *Male.* Face narrow, silvery white, slightly widened above; palpi small, silvery white, with whitish hairs. Front bluish, sometimes with a brassy reflection, which makes it appear more greenish, the whole margin narrowly blackish; thinly yellowish pollinose, the pollen more evident below. Occiput green, mostly covered with white pollen, the cilia black to slightly below the level of the antennae, the pile elsewhere long, not very dense, white. Antennae black, the first two joints polished; second joint four times as wide as long, the third about three times as long as wide, tapering from base to the rather acute apex, the antennae about as long as the face; arista not quite apical, although appearing so, as long as the third joint, its basal segment slightly longer than wide.

Mesonotum green, thinly greyish pollinose; a median geminate vitta and a sub-lateral stripe bronzed; pleura green, white pollinose.

Coxae green, white pollinose and pilose, the middle ones with a strong black apical pencil, the hind ones with a pencil composed of three or four hairs. Legs yellowish; front femora blackened posteriorly and above except at base and apex; posterior femora on apical third, (only apical fourth below), the posterior tarsi and last two joints of the front and middle tarsi, black, the posterior tibiae brownish yellow, appearing blackish from most views. Long pile

on middle and front femora white. The rest of the hair black. Middle femora with one anterior and one posterior preapical bristle, the hind ones with one anterior. Posterior legs longer than usual; front basitarsus incrassated apically.

Wings cinereous hyaline, quite greyish when seen together; posterior crossvein slightly oblique and very gently curved. Squamae yellow, with white ciliae.

Abdomen bronze green, the sides green and moderately white pollinose, the narrow incisures and last segment blackish. Pile white along the sides, elsewhere black. Each segment with an apical row of black bristles. Outer lamellae brownish yellow, the three nearly equal, arms black, each arm fringed with not abundant long, straight or curved stout hairs, the outer or first branch with a dense terminal tuft of short yellow, apically curved hairs, the inner or apical branch with a smaller tuft of finer white hairs, the middle arm not with apical condensation of short hairs. Inner lamellae long, slender, yellow, broadened at the sub-apical third to form a small, whitish fringed lobe, their apical third slender, acute.

Female. Face silvery, one-fifth the width of the head; apical third of palpi yellow, base black; covered with yellow pollen, all the hairs black, one hair near the apex distinctly stronger than the others; front nearly one-quarter the width of the head, bright blue, on the lower half rather thickly white pollinose, above, thinly so.

Legs yellow, the last two joints of the front four and the whole of the posterior tarsi, blackish.

Holotype and *Allotype*—♂ ♀ in coitu, Hull, Quebec, June 15, 1923, (C. H. Curran); No. 622 in the Canadian National Collection, Ottawa.

Paratypes—4 ♂ and 4 ♀, same data, ♂, 8 ♀, June 11, ♂, 3 ♀, June 17, 2 ♀, June 18, 1923, (C. H. Curran). Two pairs in coitu, Megantic, Que., June 18, 2 ♂, 12 ♀, same data, ♀ June 20 (C. H. Curran).

This species differs from *P. tridactyla* Frey. of Europe in having the middle tarsi plain. In *tridactyla* the arms of the genital lamella are not equal in length, the inner being less than a third as long as the terminal and the inner lamellae are short and broad.

Rhaphium petchi new species ..

I have hesitated to describe this species from the female sex but it is so well marked that I feel justified in doing so, and am sure that the male will be easily recognized. According to the relationship of the female it appears certain that the male has an enlarged tip to the arista, and it must be very similar to *P. signifer* O.S., but is probably larger, with paler legs.

Female. Allied to *P. signifer* O.S., but the posterior tibiae are yellow on the basal half; middle coxae with an area of black hairs on the outside toward the anterior apex as in *signifer;* middle femora with two stout anterior and two or three posterior, preapical bristles.

Length, 5 to 5.5 mm. *Female.* Face one-fourth the width of the head, silvery pollinose, the separating groove deep, leaving the upper part of the face but little longer than wide. Front coppery, greenish in the middle above, very thinly silvery pollinose in some lights. The black occipital cilia reach to the level of the antennae, the rest of the hairs greyish white; occiput whitish pollinose,

bronzed above. Palpi black, with greyish yellow pollen and black hairs; proboscis black, with similar pollen. Antennae black third joint sub-triangular, nearly one and one-half times as long as wide, slightly convex above, gently concave below, arista twice as long as the antennae, its apex very slightly thickened.

Mesonotum bronzed, with irregular green vittae in various lights, with two approximate more brownish vittae, between which the thin whitish pollen is more concentrated. The sides before the suture are white pollinose, behind it scarcely darker than elsewhere. Pleura blackish, the middle green, thinly whitish pollinose.

Coxae wholly dark, with greyish white pollen and pile, the middle ones with black pile apically, exterior to the origin of the trochanters, the others without any black hairs or bristles. Trochanters black. Anterior femora brownish black, with more or less greenish lustre, thinly pollinose, the obscure bases and about the apical sixth, reddish; apical two-fifths of the posterior femora, apical third of their tibiae, the whole of the posterior tarsi and the last three and one-half joints of the remaining tarsi, black, the legs elsewhere yellow. Only on the posterior surface of the front and middle femora is there fine white hair, the rest being shorter and black. Front and hind femora each with one anterior and one posterior pre-apical bristle, the middle ones with two anterior and two strong posterior preapicals and sometimes an additional smaller one behind Posterior basitarsus scarcely shorter than the following joint.

Wings cinereous, a little darker on apical half in front, the cross-vein practically rectangular. Squamae yellow, with white cilia; halteres pale yellow, their stems slightly brownish.

Abdomen brassy green, in some lights pearly whitish pollinose, the sides more thickly so, the bases of each segment, expanding in the middle as a narrow triangle, more or less cupreous. There is very little white pile on the sides of the abdomen.

Holotype— ♀, Hemmingford, Que., June 29, 1923. (C. H. Curran), No. 623, in the Canadian National Collection, Ottawa.

Paratype— ♀, same locality, June 27.

Besides being smaller than *P. slossonae* Johns., this species has a slightly wider, less white face, more extensively black posterior femora and dark front femora.

It is with pleasure that I name this species in honour of Mr. C. E. Petch, with whom I spent a pleasant week collecting in the vicinity of Hemmingford.

Rhaphium spinitarsis new species

Femora black, face moderately narrow, silvery white; middle basitarsi with several long black bristles below, anterior four tibiae wholly yellow, the hind ones black with the dorsal two-thirds pale yellow.

Length, 4 mm. *Male*. Face moderately narrow, with nearly parallel sides, slightly widened on upper third; silvery white. Front green to black green, bare. Occiput green, very thinly whitish pollinose. Beard yellowish. Palpi black, with brownish yellow anterior margin, the hairs black. Antennae black, the third joint twice as long as wide, acute (not as long as the face); arista as long as the face, its penultimate joint about twice as long as wide, swollen.

Mesonotum green, usually almost all bronzed, with a dull bronze line out-

side the acrostical bristles. Pleura green and bronzed, grey pollinose. Prothorax yellowish pilose.

Coxae green or black, grey pollinose, with yellowish pile, middle coxae with a long, slender black thorn, and a black bristle on the outer margin towards the end, the posterior ones without bristle. Coxae, femora, posterior tibia and tarsi, black, the posterior tibiae yellowish on the basal two-thirds of their dorsal surface. Anterior femora with moderately long black hairs behind, below with long pale hairs on more than the basal half, the middle ones with pale hairs below on basal half and very long pale hairs on basal third of the postero-ventral surface. Front femora with posterior, middle with one anterior and posterior, the hind with anterior preapical bristle. Anterior four tibiae pale yellowish. Anterior four tarsi black from the tip of the first joint; anterior basitarsus gradually very slightly thickened to apex, but not conspicuously enlarged, the three following joints very strongly compressed and much higher than wide, the hair conspicuous on the basitarsi. Middle basitarsi with three unusually long bristles on the basal fourth below, and a smaller one just before the middle.

Wings brownish tinged, with crossvein almost rectangular. Squamae and halteres yellow, the former with white ciliae.

Abdomen green, with bronze reflections, thinly greyish pollinose, the sides evidently only a little more so. Hairs black, on the sides and venter yellowish. Genitalia black, outer lamellae brown, with black hairs, the inner shining black.

Holotype—♂, Strathclair, Manitoba, August 8, 1923. (H. A. Robertson), No. 650, in the Canadian National Collection, Ottawa.

Paratypes—1 ♂, Tennessee Pass., Colo., 10,240 feet, July 9th; 1 ♂, Utah? Nev? Calif.? In the United States National Museum, Washington, D.C.

Rhaphium arboreum new species

Allied to *R. flavicoxa* Van Duzee, but differing in the genital lamellae, which are composed of two elongate branches in *arboreum* but are triangular and unbranched in *flavicoxa*. The posterior tibiae are chiefly yellow in *arboreum*, but brown on inferior side almost to the base, chiefly brownish in *flavicoxa*.

Length, 3 mm.; antennae .8 mm. *Male*. Face silvery white, narrowest at upper third, not as wide below as above. Front bluish with a narrow green margin, but so densely covered with silvery white pollen as to practically conceal the blue color, although it is quite apparent in the newly captured specimens. Occiput green, largely white pollinose, the cilia black to the level of the antennae, white below. Antennae black; third joint one-fifth longer than height of head, very slightly tapering, distinctly pubescent; arista slightly longer than basal width of third joint, very shortly pubescent. Palpi and proboscis brownish, the former with black hairs.

Mesonotum green with slight brassy reflection, thinly greyish yellow pollinose. Before the base of the wings is a triangular opaque black spot reaching the suture, before which the sides are white pollinose. Pleura usually purplish or blue-green with rather thick whitish pollen. Basal scutellar bristles very small, inconspicuous, white.

Legs, including the coxae, whitish to yellow, the front tarsi from the apex of the second joint, middle tarsi from the apex of the first joint and the posterior tarsi wholly, blackish or brown, the posterior basitarsus paler on basal half in

many specimens, the posterior tibiae more or less infuscated on apical fourth, sometimes more on the ventral side, often scarcely so on dorsal surface, but they appear wholly darker than the others because of the abundant black hairs. Middle coxae usually with a basal fuscous spot, this sometimes extending over half way to the apex. All the coxae white haired, the legs wholly appressed black pilose. On the postero-ventral surface of the front femora are four or five increasingly longer, small black bristles, the middle femora with one preapical bristle on either side, and sometimes two or three longer black hairs near it, the posterior femora with one anterior preapical bristle, the hairs towards the base on the dorsal surface longer than elsewhere. Anterior basitarsi not swollen at apex; first joint of hind tarsi slightly shorter than the second.

Wings cinereous, slightly darker apically in front. Squamae yellow with yellowish ciliae, one or two often black. Halteres yellow.

Abdomen brassy green, the sides not very broadly thinly white pollinose; pile black, white at the sides on basal half. Genitalia black, lamellae yellow basally, sometimes brownish yellow, its apical three-fourths or more usually black; at its basal fourth it is split into two nearly equal ribbon-like appendages which are about five times as long as wide, and fringed with rather long, sparse yellow hairs, their apex rounded. They vary slightly in width and shape, sometimes being widest at the middle, at other times their sides almost parallel. The inner lamellae are usually hidden, they are nearly as long as the outer, their base apparently somewhat triangular, produced forward at their apex as a short, apically swollen prong.

Female. Face with parallel sides, nearly as wide as the length of the antennae, silvery white; front as in ♂; third antennal joint not longer than first, cordate, as wide as long, its arista four-fifths as long as height of head. Palpi with silvery-brownish pollen and black hairs.

Posterior tibiae wholly yellow, their basitarsi yellow, except apically. Abdomen colored as in ♂.

Holotype—♂, Megantic, Quebec, June 17, 1923, (C. H. Curran); No. 626 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—6 ♂, 3 ♀, same data; ♂, 4 ♀, June 20.

The pale coxae and shape of the genital lamellae at once distinguish this pretty little species from its allies.

R. arboreum apparently is a wood species. I found it in the vicinity of a small stream in a very dense and tangled wood on the shores of Lake Megantic. It was found most commonly on a leafy muddy slope, where it was extremely difficult to locate owing to its minute size. It was not possible to sweep owing to the underbrush. Shortly after, I located it again further up the side of the hill, where it was sunning itself on leaves, but failed to capture specimens by sweeping. Only in these two moist spots was it in evidence and it was taken at no other place, although I searched for it whenever I came to what I thought might be its habitat.

A NEW MESOVELIA WITH SOME BIOLOGICAL NOTES REGARDING IT (HEMIPTERA-MESOVELIIDAE)*

BY H. B. HUNGERFORD,
University of Kansas, Lawrence, Kansas.

A single species of the genus Mesovelia M. & R. has been known from North America. This species, described by Doctor Uhler under the name *Mesovelia bisignata* Uhler in the Standard Natural History, Volume II, p. 274, 1884, is considered a synonym of *Mesovelia mulsanti* White by E. P. Van Duzee in his Catalogue. *Mesovelia mulsanti* White was described from the Amazons and, if the specific identity is correct, this species has a very wide range. Champion records it from Central America, and it is distributed widely over North America. I have found it a common species in New York, Wisconsin, Minnesota, Michigan, Kansas and Texas. It is recorded from Florida, Massachusetts, New Jersey, Maryland, North Carolina, Ohio, and Illinois as well. It dwells upon rafts of filamentous algae, leaves of the water shamrock, lily pads, etc., floating about the margins of the water. Its life history was described by me in Psyche, Volume XXV, p.73, 1917.

It was, therefore, a very great surprise and pleasure to me to take a single female of a much smaller species on July 29th while collecting Microvelias amongst a thick growth of *Chamaedaphne* about the margin of the little pond in the middle of Bryant's Bog. (This bog is at the southwest side of Douglas Lake in the northern part of the southern peninsula of Michigan. The Biological Field Station of the University is on the southeast shore of Douglas Lake). On August 1st I made a second trip to the pool in search of more specimens of this species and brought back six specimens, all females. August 3rd I started early and spent the day collecting this interesting little species. I secured both sexes and some nymphs. They were not abundant, and it took many dips of the net into the water beneath the thick growth of the *Chamaedaphne* to capture a specimen. Persistent effort, however, resulted in the capture of about forty specimens. Some of these I brought back to the laboratory alive in a four-ounce bottle containing some dry celu, which, by the way, is a most excellent way to transfer Aquatic Hemiptera from the field to the laboratory. From this living material I secured the biological notes which are recorded beneath the description which follows.

Mesovelia douglasensis new species

Size: *female*—length 2.1 mm.; width across abdomen .8 mm.; across head .5 mm.; *male*—length 1.8 mm.; width across abdomen .6 mm.; across eyes .5 mm.

Shape: Sexes more robust than *Mesovelia mulsanti* White (*M. bisignata* Uhler).

Color: Olive-brown, sutural markings dark; pattern of pale and dark areas of variable proportions, giving a mottled appearance; gray on head, prothorax, metathorax, and coxal elevations; dorsum of metathorax entirely gray save for a median triangular patch of brown which lies with its base against the anterior margin and sometimes has its apex attaining the first abdominal segment—thus dividing the gray into two lateral areas—metathorax with faint median light spot, ill-defined, and prothorax with three gray patches, a median transverse spot and lateral more or less round ones. The gray on the head confined to a border along the inner margin of the eyes, then spreading upon the cheeks;

*—Contribution from Biological Field Station, University of Michigan, Douglas Lake, Michigan.

three longitudinal dark-brown stripes upon the head, the median one very slender; near the lateral margins of the lateral stripes, three pairs of setiferous black dots, one pair on caudal margin of the head, the other two pairs before the eyes.* The brown upon the dorsum of the abdomen variable, usually leaving a light median spot on first abdominal segment and more or less definite light median spots back of the fourth segment, which bears the repellant gland pore; this segment and the seventh, usually pale; legs, venter and basal segment of antennae, pale.

Structural details: Body appearing glabrous but minutely and sparsely pilose; arrangement of setae on head and limbs as follows: several on tylus, three long ones on first antennal segment about a third from tip, one on front margin of anterior femur near its tip, two on front margin of middle and hind femur. Eyes coarsely faceted; antennae reaching back to anterior margin of seventh abdominal segment; first segment, stout and slightly curved, not attaining rear margin of eyes when reflexed; second segment, a little shorter than the first and more slender; third and fourth segments, very slender; third about twice as long as second and fourth, a little longer than the third, more pilose, pitted and annulated, and slightly broadened toward the tip. Anterior femur and tibia, subequal in length; middle tibia slightly longer than middle femur; hind tibia distinctly longer than hind femur; the three segmented tarsi a trifle less than half as long as the tibiae in front and middle legs and about one-third as long in hind legs; first tarsal segment shortest in all tarsi; third longest and largest in front and middle feet, equal to other two together in length; second and third tarsal segments of hind feet nearly equal; hind femur of male surpassing abdomen; beak attaining apex of hind coxae in both sexes.

Comparative notes: This species is about one-half the size and a little more robust than our generally distributed and well-known *Mesovelia mulsanti* White (*M. bisignata* Uhler). It is brown instead of green. The beak is longer attaining apex of hind coxa, whereas in *M. mulsanti* the beak reaches to the base only of the hind coxae. The appendages are all stouter. The first antennal segment is shorter, stouter and more curved. The connexivum relatively narrower, in *M. mulsanti* the greatest width of connexivum is nearly one-half the width of the remaining dorsum, while in *M. douglasensis* it is but one-third or less. The stout spines on rear margin of front and middle femora of *M. mulsanti* are lacking or minute in the new species. The male of *M. mulsanti* has a pair or black tufts on the venter of the first genital segment. These are lacking in *M. douglasensis*. The latter has a fringe of short spines on the caudal margin of the ventral abdominal segments, especially marked on the second segment in front of the first genital segment. These spines are lacking in males of *M. mulsanti* White. The male genital claspers of *M. douglasensis* are long, slender, and angulate, those of *M. mulsanti* short, stout, and hook-shaped. The penultimate ventral plates of females of *M. mulsanti* White are armed with hook-like projections. These are lacking in *M. douglasensis*.

The comparison of formulae for antennae and limbs of the two species follows:

Antennae of Females—Formula for Segments

M. mulsanti: 1st: 2nd: 3rd: 4th:: 18: 12: 20: 25

M. douglasensis: 1st: 2nd: 3rd: 4th:: 9: 7: 5 16: 20

*—Apparently a generic character.

Legs of Males—Formula for Segments

	Front Leg	*Hind Leg*
M. mulsanti:	femur : tibia : tarsus : : 27 : 22 : 8	femur : tibia : tarsus : : 41 : 52 : 14
M. douglasensis:	femur : tibia : tarsus : : 17 : 17 : 7	femur : tibia : tarsus : : 27 : 36 : 10

Middle Leg

femur : tibia : tarsus : : 26 : 33 : 11

femur : tibia : tarsus : : 20 : 21 : 7.5

Described from fifteen males and thirty females, all apterous, taken from Bryant's Bog pool on the margin of Douglas Lake, Michigan. The color description is drawn from living material. The lighter part of the pattern, which is olivaceous in life, changes to testaceous, and the gray becomes obscure in museum mounts. Holotype and allotype in Kansas University Museum, paratypes in the University of Michigan Museum, U. S. National Museum and the private collections of J. R. de la Torre Bueno, Dr. Carl Drake, Dr. H. M. Parshley, H. G. Barber, Dr. R. F. Hussey, William E. Hoffman, and myself.

Biological Notes: The habits of this species are much as I have recorded them for *Mesovelia mulsanti* White. It seems, however, to live in much more sheltered and inaccessible places, preferring the dark and shadowy waters beneath the dense growth of *Chamaedaphne* to the sun-lit haunts of its well-known relative. In the pairs that I have observed mating in captivity, the males have been supported very curiously above the female by the genital clasp alone—all of the legs poised in mid-air. They have remained in copula for thirty minutes and longer. The females place their eggs in the tissues of plants after the manner I have described for *M. mulsanti* White. The first I found were in the petiole of a black water-soaked dead leaf of *Andromedra glaucophylla* Link. The general shape of the egg and its position in the stem is the same as I have shown for *M. mulsanti*. The egg is elongate oval, with a curved neck terminating in a flat surface which marks the exposed end of the egg as it lies in situ in the plant stem. It measures .75 mm. in length and .2 mm. in width and is a little plumper than the egg of *M. mulsanti*. The curved neck is larger proportionately. The nymphs are brown, plump little fellows readily distinguishable from those of the other species. In every way *Mesovelia douglasensis* is a distinct and interesting little species, and I am glad to record it as a second species of Mesovelia for North America.

NEW SPECIES OF THE GENUS PHLOEOSINUS CHAPIUS (COLEOPTERA)*

BY J. M. SWAINE,
Ottawa, Ont.

Phloeosinus rubicundulus new species

Length, 3 mm.; width, 1.2 mm.; colour black, the elytra red brown to piceous.

The head has the front convex, rather coarsely not densely punctured, the median line smooth, carinate anteriorly, sutures of antennal club strongly oblique.

The pronotum is narrowed strongly from the base, the sides straight on the basal half, subconstricted in front, the punctures of average size, only moderately close on the disc, close on the sides and deep, making the surface somewhat

*—Contribution from the Division of Forest Insect, Entomological Branch, Dept. of Agric., Ottawa.

rough; the median line indistinct; broadly impressed on each side the middle near the caudal margin; proepisternum smooth on the caudal half; intercoxal piece of prosternum narrow, the mesosternum oblique.

The elytra are deeply, coarsely punctate-striate, the interspaces wide and convex on the disc, very coarsely rugulose, densely at the base, gradually more sparsely and coarsely behind, the granules uniseriate and acute at the declivity; on the sides the interspaces rather feebly rugose, subseriate at the apex; the striae deeply impressed, much narrower than the interspaces but with coarse, easily distinguished, closely placed, elongate punctures. The declivity of the female shining, striae deeply impressed, strial punctures small with the first and third interspaces rather feebly serrate, more strongly convex and wider than the second, the first wider on the declivity than on the disc; the second narrower than the others, much narrower than on the disc, its sides subparallel, feebly widened at the apex, not serrate, only feebly punctured; the declivity sparsely clothed with extremely minute and indistinct scales.

The male declivity has the first interspace feebly elevated with only two or three widely separated serrations on the face of the declivity. This is apparently an approach to the condition found in males of *cupressi* Hopk. and *nitidens* Sw.

It differs from *cupressi* in the relatively smaller pronotum, with coarser and sparser punctures on the disc, much more coarsely and less closely granulate elytral interspaces, the female declivity less strongly serrate and punctured, the male declivity with the first interspace feebly elevated and sparsely serrate on the face. It differs from the single known male of *nitidus* in the narrower pronotum, less strongly arcuate on the sides, smaller strial punctures of the elytra and the feeble declivital serrations.

Holotype— ♀, Hossack Meadows, Tulare Co., Cal., June 25, *Sequoia gigantea*, Lot 302, (Ralph Hopping); No. 729, in the Canadian National Collection.

Allotype— ♂, same labels.

Paratypes— 2 ♂s, 6 ♀s, same labels.

Phloeosinus nitidus new species

A small, subelongate species, closely allied to *cupressi* Hopk. Length 2.5 mm.; black with elytra piceous.

The front is granulate-punctate with a large median concavity.

The pronotum is much as in *cupressi*, shining, with punctures moderate, rather close and deep; with the surface of the disc somewhat rugose.

The elytra interspaces are sparsely, finely punctured on the disc, the punctures more confused towards the base; sparsely transversely rugose across the punctures, the interspaces on the sides of the elytra nearly smooth with the punctures very fine and the rugosities distinct only towards the declivity; the striae nearly one-half as wide as the interspaces on the disc, with the punctures shallow, very large and usually distinctly longer than wide; declivital serrations very coarse and black, as in male of *cupressi*, uniseriate granules on the caudal part of the first interspace increasing into three or four coarse serrations which end abruptly at the top of the declivity; third interspace on the declivity closely, coarsely serrate uniseriately from the disc to the apex, the fifth and seventh interspaces with a few serrations on the sides of the declivity; the face of the declivity

between the third interspaces nearly vertical, subplanate, shining, roughly punctured, and with sparse, fine hairs.

The female probably has declivital characters similar to those of *cupressi* Hopk.

Holotype— ♂, Santiam, N.F., Oregon, 8.25-14, (W. J. Chamberlain); No. 730, in the Canadian National Collection.

The type is retained in the Canadian National Collection, Ottawa, through the kindness of Prof. W. J. Chamberlain.

The relationships of *nitidus* and *rubicundulus* are expressed in the following table, which is a revision of part of the key to *Phloeosinus*, Canadian Bark-Beetles, Part II, page 69.

C The elytral striae strongly impressed on the disc, of moderate width, with the punctures coarse and distinct; the female with the first and third declivital interspaces subequally strongly serrate; the male with the first declivital interspace coarsely serrate at the top of the declivity and unarmed behind or sparsely and feebly serrate throughout.

D Pronotum strongly arcuate on the sides; the declivital serrations strongly developed; ♂ first interspace armed only at top of declivity.

E Lateral interspaces of the elytra strongly transversely rugose; discal interspaces closely granulate; length, 3 mm. to 3.6 mm ..... *cupressi* Hopk.

EE Lateral interspaces of the elytra almost smooth except near the declivity; discal interspaces very coarsely, sparsely granulate; a smaller, narrower species ..... *nitidus* Sw.

DD Pronotum with sides narrowed, straight or feebly arcuate on basal half; declivital serrations feebly developed; ♂ first interspace with two or three small serrations on declivital face ..... *rubicundulus* Sw.

Phloeosinus antennatus new species

Length 2 mm.; black with the antennae red and caudal half of the elytra reddish brown.

The head has the front transversely impressed, with a strong median carina, the antennal club rather stout with the sutures subtransverse.

The pronotum is as wide as the elytra, with the sides straight and parallel on the caudal half, then strongly constricted and broadly arcuate in front; deeply, closely punctured, the surface roughened, the median line indistinct; the prosternal process wide; the mesosternum steep.

The elytra interspaces on the disc have a row of coarse granules; closely, finely granulate-punctate, convex, wider than the striae; the striae deep, with the punctures distinct, longer than wide; the declivity with first and third interspaces convex and feebly, sparsely serrate; the pubescence of elytra evident but short and stout, and scale-like on the declivity.

This species is most closely allied to *minutus* and belongs with it in the

key. It is distinguished by its more slender form, narrower and more densely rugose interspaces, the declivital pubescence more scale-like, the antennae conspicuously reddish, and the caudal half of the elytra reddish-brown.

Holotype—Strawberry, Cal., 5|VI|17, *Librocedrus,* (W. J. Chamberlain); No. 731, in the Canadian National Collection.

Paratypes—11 specimens, same labels.

The holotype and four paratypes are in the Canadian National Collection; the remaining paratypes are in the collection of Prof. W. J. Chamberlain, to whose kindness I am indebted for the material.

The relationship of *antennatus* to its allies is expressed in the following table, which is a revision of a portion of the key to *Phloeosinus* in Canadian Bark-Beetles, Part II, page 67.

C The second interspace on the declivity evidently narrower than the first and third.

D Sutures of club subtransverse, pubescence distinct; the discal interspaces with coarse, uniseriate asperities in addition to the granules; very small species, length 2 mm. or less.

E First and third interspaces on the declivity strongly convex and serrate; discal interspaces indistinctly punctured ..... *hoppingi* Sw.

EE First and third interspaces on the declivity feebly convex and feebly serrate; discal interspaces closely granulate-punctate.

F Discal interspaces but little wider than the striae, densely rugose; declivital pubescence scale-like; antennae and elytral declivity reddish ..... *antennatus* Sw.

FF Discal interspaces much wider than the striae, sparsely rugose; declivital pubescence somewhat hair-like; colour entirely black. ..... *minutus* Sw.

DD Sutures of club strongly oblique, striae wide with punctures very coarse; discal interspaces confusedly, very coarsely granulate; of medium size, 2.2 mm. to 3 mm. long ..... *punctatus* Lec.

Phloeosinus fulgens new species

Length 2.6 mm.; width 1.2 mm.; colour dense black with antennae, tarsi and maxillae red; pubescence everywhere minute, almost invisible.

The head has the front broadly, deeply concave, closely and deeply punctured; the median carina obsolete; antennal club slender, with the sutures rather strongly oblique.

The pronotum is large, almost as wide as the elytra, wider than long, sides nearly straight and subparallel on basal half, hind angles rounded, strongly broadly constricted in front; closely, moderately punctured, densely on the sides and

subgranulate, the median line indistinct; the intercoxal piece of prosternum is narrow, the mesosternum *oblique*; the smooth space on the proepisternum small and central.

The elytra have the striae impressed, first more strongly than the others; strial punctures of medium size, distinct; interspaces much wider than striae, feebly convex, rather coarsely, very closely granulate-punctate on the disc, the median row of coarser granules indistinct, the lateral interspaces coarsely, roughly punctured; the declivity brightly polished with striae deeply impressed, strial punctures as large as on the disc, first and third interspaces slightly more elevated than second, each with a row of sparse, very small, nearly obsolete serrations, and small but rather numerous punctures, second interspace flat, more brightly polished, as wide as the others, without serrations and only indistinctly punctured.

This species is most closely allied to *rugosus* Sw. and *juniperi* Sw., but is distinguished readily by the smaller size, more slender form, indistinct pubescence, shape of pronotum, deeply excavated front of the head, brightly polished declivity (♂) and feeble declivital serrations.

Holotype—♂, Northfork, Cal., 2|III|20, *Libroccdrus decurrens*, (H. Dietrich); No. 732, in the Canadian National Collection.

The type is retained in the Canadian National Collection through the kindness of the collector, Mr. H. Dietrich.

Phloeosinus russus new species

Length 2.3 mm.; colour rufous (probably immature), very closely allied to *vandykei* Sw., from which it is readily distinguished by the following characters; lustre feebly shining, clothed everywhere with short, stout, easily distinguished pale pubescence, (in *vandykei* the pubescence is almost obsolete) the elytral interspaces more strongly convex, much more strongly granulate, the median row of acute granules large on the disc, evident everywhere on the sides, slightly smaller on the declivity.

The front is feebly impressed with a short, feebly developed carina.

Holotype—♀, S. B. Mts., Cal., 7|19|92, (H. C. Fall); No. 733, in the Canadian National Collection.

Through the kindness of Dr. H. C. Fall, the type is retained in the Canadian National Collection.

Phloeosinus scopulorum new species

Allied to *dentatus* Say and *canadensis* Sw., but somewhat larger. Length 2.8 mm.; black when mature with the elytra piceous.

The front is densely granulate-punctate with a somewhat transverse median impression.

The pronotum is wider than long, very strongly narrowed and subconstricted in front, the punctures of the disc very close, deep, of median size, not granulate, the discal surface shining, with the median line narrow and distinctly elevated.

The elytra is one-fourth longer than wide; the discal interspaces wide, feebly convex, confusedly granulate, rather closely punctate from the base to the declivity, the granules usually small but coarser towards the base, and becoming moderately coarse, uniseriate, black serrations on the first and third interspaces of the declivity; those of the first interspace usually less numerous; the second

interspace on the declivity flat, closely punctured, not seriate, and noticeably narrowed at the apex; the declivity polished, and with the pubescence exceedingly minute and indistinct; the lateral interspaces hardly granulate, only very feebly so at the sides of the declivity.

The female has the front closely granulate-punctate; sub-convex with a very small median impression; the declivital serrations smaller and more numerous and the declivity rather densely clothed with very minute, stout, indistinct hairs.

Distinguished from *canadensis* Sw., to which it is most closely allied, by larger size, less evident pubescence, more closely and finely granulate discal interspaces, without the subuniseriate larger granules throughout the length, and feeble development of granules on the lateral interspaces. Distinguished from *dentatus* Say by the characters just given and by the smooth and apically narrowed second declivital interspace.

Holotype—♂, Williams Lake, B.C., 21|VIII|21, *Juniperus scopulorum*, 17042, (Ralph Hopping); No. 734, in the Canadian National Collection.

Allotype—♀, same labels.

Paratypes—3 ♂s, 6 ♀s, same labels.

A NEW SERICOTHRIPS (THYSANOPTERA) INJURIOUS TO COTTON

BY J. DOUGLAS HOOD,

University of Rochester, Rochester, N.Y.

The insect described below was taken by Mr. August Busck, of the Bureau of Entomology, U. S. Department of Agriculture, in Tlahualilo County, Coahuila, Mexico, in October, 1917, where, in association with somewhat larger numbers of *Heliothrips phaseoli* Hood, it is said by its collector to have rendered worthless several thousands of acres of cotton. Various species of the genus *Heliothrips* are of economic importance, and at the time of its description *H. phaseoli** was recorded as a serious pest of beans at Brownsville, Texas, and Matamoras, Mexico, in 1908; but no species of *Sericothrips* has heretofore brought itself to the attention of the economic entomologist.

Sericothrips gracilipes sp. nov.

Female (macropterous). Length about 1 mm. Color straw yellow; middle of pronotum with an obscure, dark, transverse blotch (best seen by reflected light) which shows a tendency to divide along median line; mesoscutum and metascutum each with about two obscure dark blotches, less distinct than pronotal blotch; all coxæ and distal portions of mid and hind femora slightly darkened; abdominal segments 2-7 each with a dark lateral spot and a dorsal transverse line bordered posteriorly with a brown band, the latter often broadened at sides of abdomen; antennæ with segment 1 nearly white; 2 yellowish and darkened at sides; 3 pale yellowish, darkened with gray just beyond pedicel and again at apex; 4 pale yellowish, with pedicel slightly, and distal half decidedly, darkened; 5 with pedicel dark, followed by a narrow pale ring, yellowish gray beyond, dark gray in distal half; 6-8 uniform dark gray; fore wings pale yellowish, with scale and a narrow band at basal third, gray; hind wings with a narrow median gray line,

*—Psyche, Vol. XIX, No. 4, pp. 113 and 114; 1912.

except at base and apex this line darkest in basal third; all bristles and fringes gray; ocellar pigment bright red.

Head rather small, about 1.7 times as wide as long, distinctly broader across eyes than behind them, surface without noticeable sculpture, bristles as usual in the genus. Eyes rounded, prominent, protruding, a little narrower than their interval and somewhat longer than cheeks, pilose. Antennæ more than three times as long as head, segments formed as usual in the group, sixth not pedicellate. Mouth cone long, slender, prolonged at tip well onto mesosternum.

Prothorax about 1.4 times as long as head and about 1.4 times as wide as long, sides broadly rounded; pronotum with the usual raised, anastomosing, transverse lines (most distinctly seen in the dark median area) and with the single large bristle at the posterior angles prominent, long, curved, gray. Fore wings with about 21 bristles on costal margin; principal vein with a basal group of three pale bristles, followed by about 19 darker ones; no additional bristles in an additional series at tip of wing. Legs markedly long and slender, the hind tibiæ about 1.7 times as long as width of head.

Abdomen rather slender but decidedly wider than pterothorax; sides with the usual pubescence, which is missing from the median portion; all bristles slender, yellowish but inconspicuous.

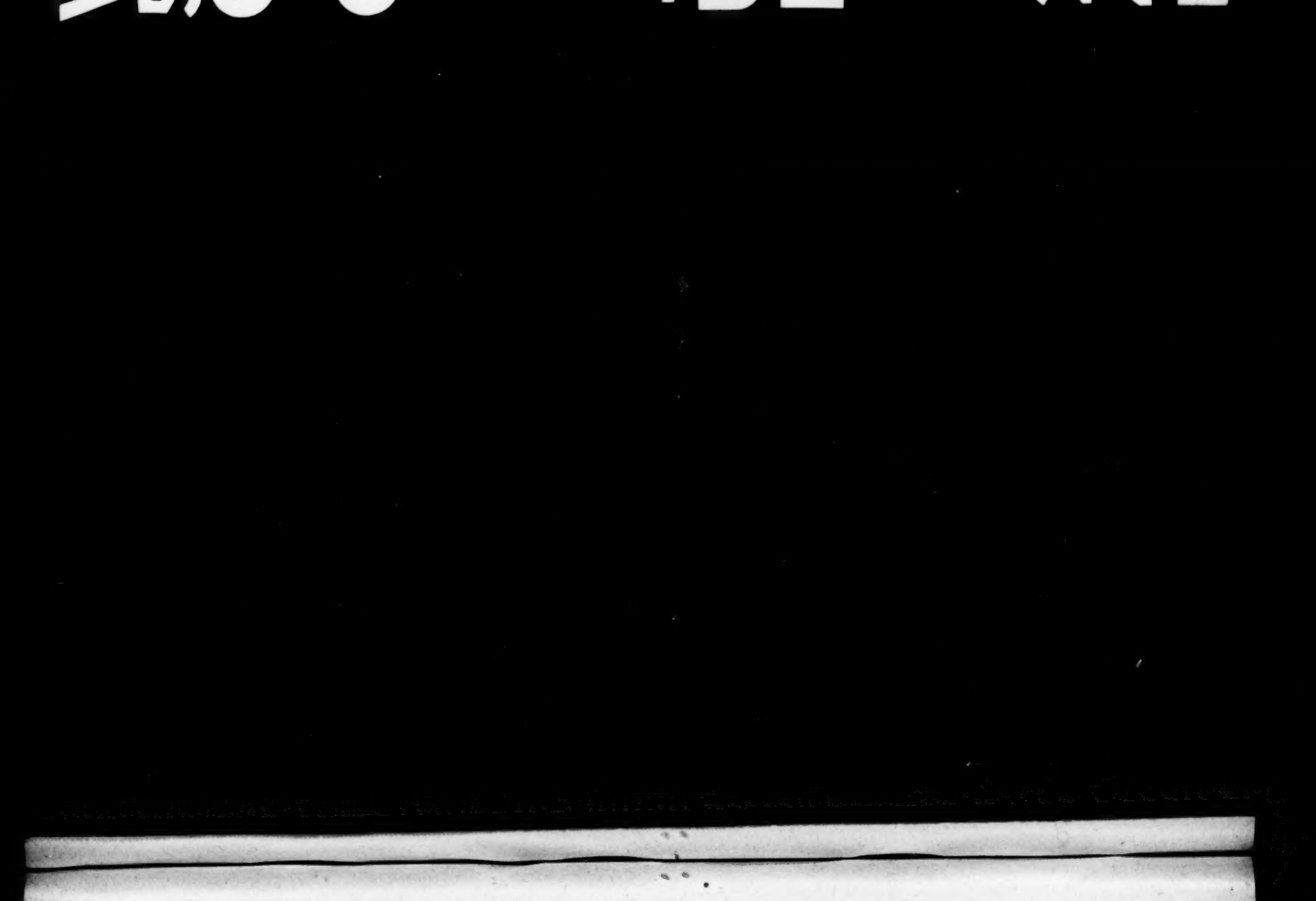
Measurements of holotype: Length 0.99 mm.; head, length 0.08 mm.; width across eyes 0.137 mm., eyes, length 0.057 mm., width 0.042 mm., interval 0.052 mm.; prothorax, length 0.114 mm.; width 0.16 mm.; pterothorax, width 0.23 mm.; abdomen, width 0.28 mm.; fore wings, length 0.72 mm., width at middle 0.031 mm., at base 0.058 mm.

Antennal segments	1	2	3	4	5	6	7	8
Length (μ)	21	35	51	50	42	50	10	15
Width (μ)	24	24	19	19	15	14	7	5

Total length of antenna 0.27 mm.

Male (macropterous). Coloration as in female except that segment 2 of the abdomen is rather more darkly clouded than the others, and the subbasal gray band of the wings is somewhat darker. Form slenderer than in female, otherwise differing but slightly in structure; principal vein of fore wings with about three fewer bristles than in female.

Described from 11 females and 2 males taken by Mr. A. Busck, the lepidopterist, in Tlahualilo County, Coahuila, Mexico (Laguna District), October 25, 1917. Mr. Busck's notes on this species and on *Heliothrips phaseoli* Hood, which occurred with it, are as follows: "Causing the so-called 'bronze' or 'copra' on cotton leaves; doing very serious damage; thousands of acres of cotton rendered worthless."

Readily known by the pale coloration, the long slender legs, and the elongate mouth cone.

Mailed June 26th, 1924